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EFFECT OF *MELOIDOGYNE INCOGNITA* ON DAMPING- OFF AND ROOT- ROT OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL.) UNDER GREENHOUSE CONDITIONS

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ABSTRACT

Meloidogyne incognita was studied on damping off (*Pythium aphenidermatum*) and root rot (*Rhizoctonia solani*) diseases of tomato (*Lycopersicon esculentum*, Mill.) under greenhouse conditions. A total of seven treatments, replicated four times were taken up in RBD and the parameters were observed *viz.* germination percent of tomato at seventh, fourteenth and twenty one days after sowing the seeds, the numbers of galls per root system, root weight, shoot weight, root length and shoot length were taken after sixty days of sowing. Treatments comprised of T_0 (control),T_1 (*P. aphanidermatum), T_2 (R. solani), T_3 (M. incognita), T_4 (M. incognita+P. aphanidermatum), T_5 (M. incognita +R. solani), T_6 (M.incognita+P. aphanidermatum+R. solani)*.The fungal pathogens were inoculated in the pots before sowing. Second stage juveniles of *M. incognita* @ 1020 ml^{-1} of suspension was inoculated in the pots at seven days after germination. After seven days of sowing data observed that there was significant reduction in germination percentage of tomato seeds in the treatment T_4 as compared with T_1. Number of root-knot galls was counted at 60 days old of plants. Data indicated that the effect of individual increase inoculated of T_3 significantly the number of root- gall or compared with combined treatment of T_5 and T_4, however T_5 and T_4 were not significant from each other. Root weight of tomato plants at 60 days was recorded to study the interactive effect of *M. incognita* with *R. solani and P. aphanidarmatum.* Data revealed that T_1, T_4, T_6 significantly reduced the root weight of tomato from other treatments. Shoot weight of tomato at 60 days with *M. incognita* inoculation significant reduction as compared with other treatments.

KEYWORDS: *Meloidogyne incognita, Rhizoctonia solani, Pythium aphanidermatum*, Tomato Plant

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is one of the most important commercial and widely grown vegetable crops in the world. It is grown all over the world because of its high nutritive value and an excellent source of vitamin A and C. It plays an important role in maintaining the human health. Being rich source of lycopene, tomato is used in the treatment of cancer, especially the prostate cancer [4]. Tomatoes are severely attacked by root-knot nematodes. Root-knot nematodes cause major economic damage to crops around the world [16]. *Meloidogyne incognita*, a predominant and widely prevalent species inflicting serious losses in tomato yield [14]. A yield loss of 35–39.7 per cent has been reported due to this nematode infestation [13] [8]. The genus *Rhizoctonia* is considered as filamentous fungal taxa that do not produce asexual spores. Soil fungi, mostly associated with roots and usually pathogens. The organism belonging to this species [3]. This fungus causes damping off in seedlings, black lesions in root and seed, stem rot and rot of plant parts in contact with soil, *R. solani* can also cause foliar lesions due to the germination of basidiospores on the leaf surface [9]. *Pythium* is often referred to as a water mold; water molds prefer wet conditions for them to infect and spread. *Pythium*

causes seedling damping off and root rot and has been found to be widely spread across cropping soils, generally being more prevalent in the areas with annual rainfall greater than 350 mm [7]**.** This injury is a common cause of poor stands, which are often attributed to inferior quality of the seed or the untreated seeds [6]. *Pythium* usually attacks the root tips first and then works its way upward in the root system. Roots infected by *Pythium* are generally soft, mushy, and appear various shades of brown [12]. Nematode-fungal disease complexes, especially those involving *Meloidogyne* spp., are common among many crops and have been documented by many researchers. The association of nematodes and fungi on plants result in synergistic, additive, or antagonistic effects with respect to disease development and yield suppression. Synergistic associations are generally attribute to the enhancement of fungal infections due to the physiological effects on the plant of nematode infestation [5]**.** *Meloidogyne incognita*, *Pythium aphanidermatum* and *Rhizoctonia solani* are important pathogens of tomato and have been reported to be involved in disease complex either together or with other organisms on several groups. These microbial infections are causing economical damage than the direct effect of nematode feeding alone.

MATERIALS AND METHODS

The experiment was conducted under green house conditions in the Department of Plant protection, Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad (India) during the year 2013. The earthen pots were disinfected with 4% formaldehyde solution and filled with steam sterilized soil. The seeds of tomato cv. Heem shana were seeded in each pot after surface sterilization with 0.1% mercuric chloride for 2 minute. On germination, plants were thinned down to one plant/pot.

Rhizoctonia solani and *Pythium aphanidermatum* were isolated from the infected tomato plants. The disease plants showed the symptoms root rot and damping off. After purification it was grown on potato dextrose agar medium for 10 days at 27^{0C} in incubator.

Meloidogyne incognita was isolated from the infected roots of tomato plant. Nematodes extraction was followed by [1]. Pure culture was multiplied and after processing the number of larvae per ml suspension was counted before inoculation. The counting of nematode per ml suspension was done by means of specially made counting dish under the stereoscopic binocular microscope. .

For nematode and fungus inoculation the soil around plant collar region was removed carefully. The required quantity of nematode at the rate of 5 ml (each ml contain 1022 second stage juvenile) and fungus $2x10^4$ cfu/plant were inoculated and covered immediately with the top soil. The treatment of the interaction study consisted of nematode and fungus inoculated singly, fungus and nematode (*Rhizoctonia solani+*Nematode, *Pythium aphanidermatum+*Nematode and *Rhizoctonia solani*+*Pythium aphanidermatum+*Nematode) inoculated at sowing time and 7th day after seed sowing respectively. An un-inoculated pot was kept which served as control.

The treatments were in randomized block design with four replicates of each treatment. The plants were regularly watered. Sixty days after inoculation plants were uprooted carefully washed free of soil and observations regarding shoot length, shoot weight, root length, root weight and root gall were recorded.

RESULTS AND DISCUSSIONS

Results of interactive effect of root-knot nematode *Meloidogyne incognita*, root-rot fungus (*Rhizoctonia solani*) and damping-off (*Pythium aphanidermatum*) on germination percentage, shoot length, shoot weight, root length, root weight and root gall are presented in Table 1.

Table 1: Effect of *Meloidogyne incognita, Rhizoctonia solani* and *Pythium aphanidermatum* and their Interaction on Seed Germination, Root Galls and Plant Growth of Tomato

Treatments	Germination Percentage			Mean of Root-Knot Gall	Root Weight (gm)	Root Length (cm)	Shoot Weight (gm)	Shoot Length (cm)
	7th Day	14th Day	21st Day					
Control (Tomato alone)	18.75	85.00	95.00	00.00	1.85	10.50	7.13	33.25
Pythium aphanidermatum	23.75	63.75	55.00	00.00	0.75	9.00	1.25	27.50
Rhizoctonia solani	40.00	81.25	83.75	00.00	1.15	9.25	4.45	32.00
Meloidogyne incongita	30.00	86.25	91.25	67.75	1.53	6.00	2.43	21.50
Pythium aphanidermatum + Meloidogyne incognita	40.00	55.00	47.50	4.00	0.90	5.00	1.83	14.50
Rhizoctonia solani + Meloidogyne incognita	27.50	76.25	75.00	17.25	1.38	8.00	2.58	16.00
R. solani+P.aphanidermatum +M. incognita	33.75	72.50	51.25	3.75	0.90	7.00	0.83	16.75
C. D. (P = 0.05)	**21.73**	**16.86**	**11.38**	**16.62**	**0.51**	**1.73**	**1.27**	**3.90**

Root pathogenic fungi damping off and root- rot and root- knot nematode attacks tomato plants during the growing season and affecting germinating seeds and seedling of tomato. After seven days of sowing data observed that there was significant reduction in germination percentage of tomato seeds in the treatment T_4 (*P. aphanidermatum*+ Nematode) as compared with T_1 (*Pythium* alone). Our finding are also in agreement with [2] indicated that there was significant reduction in occurrence percentage of pathogenic fungus in tomato seedling roots.

Number of root-knot galls was counted at 60 days old of plants. Data indicated that the effect of individual increase inoculated of (*M. incognita* alone) significantly the number of root- gall as compared with combined treatment of T_5 (*R. solani + M. incognita)* and T_4 (*P. aphanidermatum +M. incognita),* however T_5 and T_4 were not significant from each other. Our finding are in agreement with [11,10] reported the reduction in number of root galls in treatments where fungus was also present along with nematodes suggested that *F. Solani* is inhibitory to nematode multiplication. [15] observed that the fungus can be isolated from root- galls in the greater percentage than non galled roots.

Root weight of tomato plants at 60 days was recorded to study the interactive effect of *M. incognita* with *R. solani and P. aphanidarmatum.* Datarevealed that T_1 (*P. aphanidermatum),* T_4 (*P. aphanidermatum+ M. incognita),* significantly reduced the root weight of tomato from other treatments.

Shoot weight of tomato at 60 days with *M. incognita* inoculated plants was found significantly reduced as compared with other treatments.

CONCLUSIONS

The present study concludes that root-knot nematode *Meloidogyne incognita* and *Pythium aphanidermatum* cause significant reduction in various plant growth parameters. The nematode galls were significantly decreased when other root- rot fungi with initial to the plants compared with those of the nematode inoculated alone. It was noticed that the combined infection with the nematode and fungus decreased nematode reproduction and this may be due to production of fungal toxins.

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Figure 1: Comprative between Control (T_0) and Inoculated with Nematode(T_3)

Figure 2: Comprative between *R. s.+P. a.*+N.(T6), *Meloidogyne incognita*(T_3) and *R. s.+M.i* (T_5)

Figure 3: Comprative between Nematode alone and Incombination with Fungal Pathogens

Figure 4: Pathogens Inoculated and Uninoculated Plants (after 60 Days)

Figure 5: Plant Growth at Twenty One Days after Inoculation of the Pathogens